THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

110TH SESSION.] FRIDAY, JULY 29, 1864. [No. 610. VOL. XII.

Proceedings of the Society.

CANTOR LECTURES.

"ON CHEMISTRY APPLIED TO THE ARTS." BY DR. F. CRACE CALVERT, F.R.S., F.C.S.

LECTURE IV.

DELIVERED ON THURSDAY EVENING, APRIL 21ST, 1864.

ANIMAL FATTY MATTERS, the various processes for liberating them from the tissues in which they are contained. Their composition and conversion into soap. Composite candles. The refining of lard. *Cod-liver*, *sperm*, and other oils. *Spermaceti* and *wax*.

It will be quite out of the question for me to enter upon a general description of the properties and composition of fatty matters, as to do so would be to undertake far too wide a field of research. All that I can attempt in this lecture is to give an idea of their composition, and to describe some of their most recent applications to arts and manufactures.

The question of the source of the fatty matters in herbiverous animals has been the subject of a great number of scientific researches, but those of Baron Liebig, Dumas, Boussingault, Payen, and Milne Edwards, have left no doubt that when the food of an animal contains a sufficient amount of fatty matter, this is simply extracted from the food, and stored or consumed according to the animal's habits, that is to say, its consumption is in ratio to the activity of the animal; thus, an animal in a state of great activity is comparatively thin, but when confined in a pen or stall it quickly fattens. These gentlemen also proved that when the food is deficient in fatty matters a portion of the amylaceous or saccharine matter becomes converted into fatty matter. The most decisive experiments on this head were made by Mr. Milne Edwards, who found that when bees were confined under a glass shade, with no food but honey, they converted the greater portion of it into wax. Notwithstanding these proofs, however, chemists found it difficult to understand how substances so rich in oxygen as amylaceous ones became converted into a class of matters containing so little of that element, but Baron Liebig has recently published a paper which has partially solved this problem, showing that animals give off during respiration a larger amount of oxygen than is contained in the air inspired, which excess must be derived from certain organic substances circulating in the blood. Fatty matters may be classed under two heads, viz., vegetable and animal. The first are generally composed of a solid, called margarine, and a liquid, called oleine. The latter generally contains three substances, viz., two solids, stearine and margarine, and one liquid, oleine. I say generally, because there are exceptions; thus in palm oil palmetine is found, in linseed oil linoleine, in sperm oil spermaceti, and in waxes several peculiar acids. Let us now examine the composition of some of the most abundant fatty matters found in animals. The knowledge of the composition of these substances, of suet for example, was most unsatisfactory until 1811, when my learned and eminent master, M. Chevreul, published his elaborate researches, by which he demonstrated the real composition of fatty matters in general, and that they might be considered as real organic salts. Thus suet is composed of stearic, margaric, and oleic acids combined with the oxide of glyceryle. The three above-named acids he showed to be composed as follows:—

	Stearic acid.	Margaric acid.	Oleic acid.
Carbon	68	34	36
Hydrogen	66	33	33
Oxygen	5	3	3
Water	2	1	1

also that oxide of glyceryle, as it is liberated from the fatty acids, combines with water and forms glycerine. He further showed that when fatty matters were saponified, the change consisted in the substitution, for the oxide of glyceryle, of the oxide of sodium or soda in ordinary hard soaps, of the oxide of potassium and potash in soft soaps, of oxide of lime, baryta, or lead in insoluble soaps. You will easily conceive the pride of M. Chevreul when, forty years later, M. Berthelot effected the synthesis of the fatty matters, the analysis of which M Chevreul had published in 1811. This he accomplished by heating in sealed tubes, at a temperature of 520° for several hours, one, two, or three equivalents of each of the above acids with one equivalent of glycerine, leaving the mixture to cool, and then boiling it in a vessel with water and lime, when the excess of fatty acids not combined during the experiment were removed by the lime, leaving the neutral fatty matter, which was dissolved by ether, and thus obtained in a state of purity. By this interesting series of researches, M. Berthelot has not only reconstituted neutral fatty matters, but showed that the oxide of glyceryle was triatomic, that is, that one equivalent of the oxide would neutralise three equivalents of the acid, whilst it required three equivalents of soda to produce a neutral stearate with three equivalents of stearic acid.

Stearic acid, $3\ (C_{68}\ H_{66}\ O_5)$, Glycerine, $C_6\ H_8\ O_6 - 4\ HO$

Stearic acid, $3\ (C_{68}\ H_{66}\ O_5) + 3$ Soda $NaO - 3\ HO$.

In fact the researches of this eminent chemist on the synthesis of organic substances have effected a complete revolution in the last few years in that branch of organic chemistry.

I shall now proceed to give you a rapid outline of the properties of these substances.

Stearic acid is a white crystalline substance, fusible at 158° F., soluble in alcohol and ether, insoluble in water, and saponified by alkalies.

Margaric acid is a solid crystalline substance, presenting the same properties as stearic, excepting that its fusing point is 140°.

Oleic acid is a fluid remaining in that state even at several degrees below the freezing point of water, and is also soluble in alcohol and ether, but not in water.

Glycerine, or the sweet principle of oils, was discovered in 1779, by Scheele, who extracted it in boiling oil of sweet almonds with oxide of lead, which, combining with the fatty acids, liberated the oxide of glyceryle, and this, in combining with water, formed glycerine. In consequence

of the numerous applications of glycerine in medicine, the French have manufactured this substance on a large scale from the liquors in which they have saponified their fatty matters into soap; but the purest and most extensive supply is furnished by Price's Patent Candle Company. In the course of this lecture I will give you a description of its preparation, as carried out at their works. Glycerine is a colourless, syrupy fluid, of sweet taste, and sp. gr. 1·28, highly soluble in water and alcohol, combining easily with hydrochloric, hydrobromic, benzoic, tartaric, &c., acids, forming neutral compounds. Diluted nitric acid converts it into glyceric acid; concentrated nitric acid into nitro-glycerine, or a substance exploding with violence by percussion, which has caused it to be proposed as a substitute for fulminating mercury, by its discoverer, Professor Sobrero. The application in medicine of glycerine has been greatly extended by its highly hygrometric properties. Thus, bandages moistened with glycerine remain constantly moist, because the glycerine attracts moisture from the air as fast as it is lost by evaporation. It has also been found eminently useful in diseases of the eye and ear. Glycerine boils at 527°, but when distilled is partly decomposed into a peculiar oily fluid, of a noxious odour, called acroleine. M. Bertholet has succeeded, by fermentation, in converting glycerine into alcohol. Again, Mr. George Wilson, F.R.S., the talented director of Price's Patent Candle Company, has applied glycerine with great success to the preservation of vegetable and animal substances. Another useful employment of glycerine is its substitution for water in gasometers, where the evaporation of the latter is a source of serious loss. Its addition to a soap solution increases the facility of forming soap bubbles to an extraordinary degree. In fact, by its aid, bubbles of seven or eight inches diameter can be produced, exhibiting most beautiful purple and green colours, the beauty of which is greatly enhanced, as Mr. Ladd will show you, when illuminated by the electric light. To prepare this peculiar soap solution the following proportions are stated to be employed:—Distilled water, 5 ounces; soap, ⅛ of a dram; glycerine, 2 drams.

The extraction of the fatty matters of animals from the tissues enveloping them is a simple operation. The old process of doing this, technically called "rendering," consisted in introducing the suet into large iron pans and applying heat, which caused the fatty matters, by their expansion, to burst the cells confining them, and to rise to the top of the contents of the boiler, which were left to stand for a few hours, and the liquid fat was then run off. The organic tissues remaining with a certain amount of fat at the bottom of the boilers were removed, and subjected to pressure so as to separate the rest of the fat, the organic tissues remaining behind being sold under the name of scraps, for feedings dogs, &c. As this operation gives rise to noxious vapours, causing thereby great annoyance, other methods have been generally adopted. For instance Mr. D'Arcet's, the leading feature of which is, to place in a boiler say 350lbs. of suet with 150 of water and 15 of sulphuric acid, carrying the whole to the boil for some hours, when the sulphuric acid dissolves the organic matters and liberates the fatty ones, which are then easily separated from the aqueous fluid. Mr. Evrard's process appears preferable. He boils the fatty matters with a weak solution of alkali; or, in other words, he uses 300lbs. of suet with half a pound of caustic soda dissolved in 20 gallons of water, carrying the whole to the boil by means of a jet of steam. Under the influence of the alkali the tissues are swollen and dissolved and the fat liberated. By these operations a better quality of fat is obtained and no nuisance is created. It is found advantageous to purify or bleach the above fatty matters by the following means. Mr. Dawson's process consists in passing air through the melted tallow, and Mr. Watson's in heating melted fatty matter with permanganate of potash. Both these processes, as you will perceive, are based on the oxydation of the colouring organic matter. Some tallow melters further clarify their tallow by adding 5lbs. of alum in powder to 100lbs. of melted tallow, which separates and precipitates any colouring matter. The white snowy appearance of American lard, which is rather deceptive to the eye than profitable, is obtained by thoroughly mixing, by means of machinery, starch in a state of jelly with a little alum and lime, with the fatty matter, by which means two ends are attained, viz., the introduction of 25 per cent. of useless matter, and a perfect whiteness from the high state of division of the same. The fatty matters from fish are generally obtained by boiling those parts of the fish containing them with water, when the fatty matters rise to the surface of the fluid, and one whale has been known to yield as much as 100 tons of oil. According to M. Chevreul, the composition of whale oil is as follows:—

Solid fats......... { Margarine, Cetine,
Liquid fats ...... { Oleine, Phocénine,

together with a small amount of colouring matter, and of phocenic acid, which gives to whale oil its disagreeable colour and odour. Many attempts have been made to sweeten whale oil by the use of weak caustic lye, milk of lime, sulphuric acid, and steam; but although a great improvement has been effected, the oil is still recognizable by its unpleasant odour. I have no doubt in my mind, from experiments made by my friend Mr. Clift, that fish oils might be obtained as sweet as vegetable oils, if proper means for their extraction were adopted. Allow me here to revert to animal facts to show you that their comparative hardness or solidity, as shown by the following table, depends upon their relative proportions of stearine and margarine, or oleine:—

	Stearine or Magarine.	Oleine.	Melting point.
Ox tallow	75	25	111·0°
Mutton suet	74	26	109·0°
Hog's lard	38	62	80·5
Butter (summer)	40	60	86·2
Do. (winter).	63	57	79·7
Goose fat	32	68	79·0
Duck fat	28	72	77·0

M. Pelouze proved some years ago that the rancidity of ordinary animal as well as vegetable oils is due to a fermentation; that is to say, that under the influence of the azotised principle associated with all fats, the fatty matters split into their respective fatty acids and glycerine, which in their turn undergo a further change, resulting in the production of volatile fatty acids, such, for example in the case of butter, as butyric, caproic, capric, and caprolic acids; in the case of goat's milk, hirsic acid; of fish oil, phocenic acid. Further, M. Pelouze demonstrated, that in the case of olive oil this change occurred a few hours after the crushing of the berries, the oil thereby coming in contact with the albuminous principles or ferment.

I shall now have the pleasure of calling your attention to some of the special applications which fatty matters receive. The first of these arises out of the action of alkalies upon these substances, the result of which is the conversion of an insoluble matter (oil) into a soluble one (soap). I shall not enter into minute details of this well-known manufacture, but content myself with touching upon some of the most recent improvements. The usual mode of making soap is to add animal fats or vegetable oils to a weak lye, or caustic solution, carrying the mixture to the boil by means of steam-pipes passing through the vessel above a false bottom, and keeping the whole in constant agitation by means of machinery. During this operation the oxide of sodium replaces in the fatty matter the oxide of glyceryle, and when the lye is killed, that is to say when all its alkali is removed by the oil, a fresh or stronger lye is added, and these operations are repeated until the manufacturer considers that the matter is nearly saponified, which is easily judged of in practice. He then

proceeds with a second series of operations, called salting which have for their object to separate the glycerine and impurities from the soapy mass, and also to render the latter more firm and compact, in fact, to contract it. This is effected by treating it with stronger lye mixed with a certain quantity of common salt, and allowing it to stand for a few hours, so that the mass of soap may separate from the fluid containing glycerine and other impurities. When the second series of operations are finished the clarifying or finishing process follows: this requires the use of still stronger lye and salt, which not only complete the saponification, but separate any remaining impurities; the semifluid mass of soap is then allowed to stand for twelve hours, when the soap is either run or ladled into large wooden moulds, and allowed to stand until quite cold. After standing for a day or so, the wooden frame is removed from the solid mass of soap, when it is divided into bars by means of a brass wire. The difference between *white curd* and *mottled* soap is caused by the addition to the fluid mass of soap of about four ounces of alum and green copperas to every 100 lbs. of soap, which gives rise to an alumina and ferruginous soap, which on being diffused through the mass by means of agitation, mottles or marbles the mass when cool. When well prepared this is the most economical soap, as no large quantity of water can be introduced to weight it, because this would cause the separation of the mottling material from the soap. *Fancy soaps* are prepared in the above manner, by the employment of a better quality of materials and the addition of various perfumes. *Rosin or yellow soap*, as its name implies, is one in which a portion of the fatty matters is replaced by rosin, which is added to the soap paste when there is but little aqueous solution of alkali left to dissolve it, so that the rosin can at once enter into the composition of the soap, instead of being dissolved in the alkaline lye and lost. Rosin soaps, nearly white, are now manufactured, owing to the discovery of Messrs. Hunt and Pochin, who have succeeded in obtaining nearly white rosins by distilling common rosin with the aid of superheated steam. *Silicated soaps* are much used in America, owing to their cheapness, which is due to the introduction of a certain amount of silicate of soda. *Transparent soap*, the method of making which was so long kept secret, is now known to be obtained by dissolving soap in alcohol and allowing a concentrated solution of it to cool slowly, when it is poured into moulds and allowed to solidify. One of the most useful and recent improvements in soap-making is that which enables the manufacturer to produce what is called *glycerine soap*, which is characterised by the retention of the glycerine of the fatty matter. Its manufacture only occupies a few hours, instead of several days, as is the case with ordinary soap. It is prepared by employing 63 parts of fatty matter, 33 of water, and 5 of alkali, which are heated to a temperature of between 350° and 400°, for two or three hours, when the mass is entirely saponified, and then has only to run into moulds to be ready for the market. But the most important discovery connected with the saponification of fatty matters by means of alkali is that recently made by M. Mèges Mouries, for this gentleman has arrived at the remarkable result of saponifying fatty matter in the space of 12 hours, and, what is more extraordinary still, at natural temperatures. If we connect this fact with the one that caustic soda is now manufactured by tons, it appears highly probable that in a few years the fatty matters of Brazil and Monte Video, instead of being sent to this country as such, will be converted into soap there, and imported thence by us in that form. M. Mouries has discovered the fact that fatty matters are susceptible, under peculiar circumstances, of being brought into a globular state, and that when in that state they present new and peculiar properties. Thus, for example, fatty matters, when kept in a damp state, usually become rapidly rancid, whilst when in the globular state they may be kept for a very long period without undergoing that change. This peculiar state can be imparted to fatty matters by melting them at 113° and adding a small quantity of yolk of egg, bile, albuminous substances, or, what is best, a solution of alkali, composed of five to ten parts of alkali for every 100 parts of oil, at the same temperature, agitating the whole for some time to bring the fatty matter into a globular condition. If at this stage the action of the alkali is continued and the temperature is raised to 140°, it is found that instead of the fatty matters requiring a long time to saponify (as is usual even at a temperature of 212°) the saponification is most rapid, because each globule of fatty matter offers an immense surface to the action of the alkali, and it is found that in two or three hours the whole of the fatty matters are converted into soap. In fact saponification is so perfect that the mass of soap dissolves completely in water; and if the purpose is to liberate the fatty acids, this can be done at once by the addition of a little vitriol. The fatty acids produced by this comparatively cold saponification are so pure that when subjected to pressure the solid fatty acids have not the slightest odour and fuse at the point of 138°. As to the oleic acid prepared by this process, instead of being brown (as is usual with the commercial acid) it is colourless, and can be employed in manufacturing soap of good quality. When M. Mouries desires to make soap with the entire fatty matter, he acts at once upon the globular fatty mass, by adding salt, which separates the soap from the aqueous fluid; it is then melted and run into moulds. Whilst speaking of the mode in which alkalies can be made to act upon fatty matters, I ought to state that M. Pelouze observed the curious fact that large quantities of fatty matters could be split into their respective elements, viz., fatty acids and glycerine, by heating them for some hours with a small quantity of soap. This discovery of his, as we shall presently see, has been taken advantage of in the manufacture of stearic candles.

Permit me to state that *soft soaps* differ from hard soaps mainly in the substitution of potash for soda, and in the omission of the salting and clarifying processes, so that the soapy mass is not separated from the excess of water, and therefore after the fatty matter has been saponified by the alkali, the whole is evaporated to the required consistency. I cannot conclude better this hasty and imperfect sketch of the soap manufacture than by the following table of compositions, showing the per centages of the various elements in the following soaps:—

Names of Soaps.	Fatty acids.	Alkali.	Water.
Curd	62	6·0	32·0
Marseilles	60	6·0	34·0
White	60	6·4	33·6
White cocoa	22	4·5	73·5
Yellow rosin	70	6·5	23·5
Calico printers	60	5·2	34·8
Silk boiling	57	7·0	36·0
Wool scouring	55	9·0	36·0
Soft	43	10·0	47·0
Theoretical	63	6·4	30·6

As it is easy to introduce into soaps a much larger quantity of water than they should contain to render their employment economical, it behoves those who use large quantities in their manufacture to ascertain the extent of the moisture contained in soaps. This may be pretty accurately approximated to by placing a quarter of an ounce, divided into thin shreds, upon a hob or other warm situation, and leaving it for several days, when it will lose nearly the whole of the water it originally contained, or about a third of its weight if it does not contain an undue proportion. In many instances the proportions of alkali in soap may seriously affect its applicability. Thus I ascertained a few years since that the quality of soap best adapted to clear madder purples should not contain more than 5 per cent. of alkali, whilst for pinks, where it is necessary to remove any loose colour which the mordants

may have mechanically retained, a more active soap is required, viz., one containing from 6 to 7 per cent. of alkali.

I have now to draw your attention to a totally different kind of manufacture, viz., that of composite, stearic, and Belmont candles. Many years elapsed between the scientific discovery by M. Chevreul of margaric and stearic acids, and their application to illuminating purposes, for it was early in 1825 that MM. Chevreul and Gay-Lussac took out a patent with a view of realising this advantage. But it was reserved for a manufacturer, M. de Milly, to perfect the manufacturing details of the processes, and to render these candles a marketable commodity. This he effected by also improving the manufacture of the wicks, and he was the first to introduce this article to the trade in 1832, under the name of *bougies de l'etoile*. Let me give you an idea of his *modus operandi*. 100 lbs. of tallow, 17 lbs. of lime previously slacked, and 1000 lbs. of water were placed in a large iron boiler, and kept at the boil for several hours by means of a jet of steam. The result was that the glycerine dissolved in the water, whilst the fatty acids united with the lime. The insoluble stearate, oleate, and margarate of lime were then decomposed by weak vitriol, under the influence of heat. Insoluble sulphate of lime was produced, and the fatty acids liberated. These, in their turn, were submitted to hot and cold pressure, which liberated the oleic acid, leaving the solid stearic and margaric acids behind; it was then only necessary to cast them into moulds containing wicks, and the *bougies de l'etoile* were produced. MM. de Milly and Motard have introduced, of late years, several important improvements into this branch of manufacture, the most important of which is that of operating under pressure, by which means they succeed in decomposing the fatty matters with 3 or 4 per cent. of lime instead of 17, this of course involving the saving of a large quantity of vitriol. M. Bouis has made a further improvement, by adding to stearic candles 3 or 4 per cent. of sebasic acid, which is extracted from castor oil, and has the high fusing point of 261°. M. Chevreul also suggested a simple method of increasing the whiteness of these candles, by the addition of a small quantity of ultramarine blue to neutralise the slightly yellow tint of the manufactured acid. One of the greatest improvements in the manufacture of these candles is that carried out by Price's Candle Company; but before describing to you this beautiful process, as adopted by Mr. G. F. Wilson, at this company's works, allow me to state a few facts. Up to 1840 the best kind of candles were those made of spermaceti or of animal fatty matters which were cold and hot pressed. In that year Mr. Wilson, whilst experimenting with the view of making candles which would not require snuffing, for the illumination on the occasion of Her Majesty's marriage, discovered that a combination of cocoanut stearine with stearic acid would make candles giving a beautiful light, and free from the necessity of snuffing. These he called "composite," and they were soon largely sold. In 1838 Mr. Fremy published his interesting discoveries, showing that when oils or fatty matters were mixed with 20 or 30 per cent of concentrated sulphuric acid, the fatty matters were split, or, as he calls it, saponified, and that sulpho-margaric, sulpho-stearic, sulpho-oleic, and sulpho-glyceric acids were formed. He further observed that boiling water decomposed the sulpho-stearic and margaric acids, and only partially the sulpho-oleic into stearic, margaric, oleic, and sulphuric acids, which last acid remains in the water together with the sulpho-glyceric acid and that portion of the sulpho-oleic acid not decomposed, the other acids remaining insoluble and floating on the surface. In 1842 Messrs. G. Price and Jones secured a patent to carry out on a practical scale the scientific discoveries of M. Fremy. In that patent two or three important facts are brought out; first, that if instead of operating at a low temperature, as recommended by Fremy, heat was employed, the action of the sulphuric acid on the organic compounds would give rise to sulphurous acid, which they discovered had the remarkable property of converting the liquid oleic acid into a solid acid called "elaidic," thus largely increasing the yield of solid fatty acids. Their mode of operating was this—10 or 12 per cent. of concentrated sulphuric acid was added to the fatty matters which had been previously liquefied by heat, and the whole was kept at a temperature of 200° for 24 hours. During that time the fatty matters were split into their primitive elements, and the oleic acid was converted into elaidic acid. The whole was then repeatedly treated with boiling water. to dissolve the sulpho-glyceric acid and other impurities, leaving the solid fats ready for distillation. Mr. G. F. Wilson has since then greatly improved this part of his manufacture, as the beautiful candles, everywhere to be seen, will amply prove. The most important improvement in a chemical point of view is the following:—He has found, for example, that fatty matters are split up into their component parts, by decreasing quantities of vitriol, as the temperature used is increased. Thus, at a temperature of 200°, 15 parts of vitriol are required; at 350°, 6 parts; at 500°, 1 part. Further, by employing this small proportion of sulphuric acid, not only is the expense of washing the fatty matters after their saponification by the acid avoided, but the distillation may be proceeded with in the same vessel. The distillation of fatty matters, first performed by Mr. Wilson, and since carried by him to a state of perfection, is based on the fact that, whilst fatty matters, if distilled by direct heat, are completely decomposed, giving rise to the noxious vapours of acroleine, from the destruction of the glycerine, &c., this evil is completely avoided in distilling them by passing a current of superheated steam at a temperature of between 550° and 600° through the mass of melted fatty matters previously brought to the same temperature. By this means the glycerine passes first without decomposition, and is then followed by the fatty acids. In fact, the distillation proceeds with such rapidity and regularity that a stranger might witness the distillation of 1,000 gallons in 24 or 36 hours, and all the time would probably suppose that water only was distilling. The results are so perfect, that the Jury at the Paris Exhibition of 1855 could hardly credit their genuineness, and actually deputed Mr. Warren de la Rue to come from Paris to verify the fact that the beautiful products exhibited were obtained in many instances from very inferior kinds of fat. The glycerine only requires redistillation to be fit for all the purposes to which it is applied. As to the acids, they are submitted to an intense cold pressure, which separates the oleic acid from the stearic, margaric, or palmitic acids. These are melted, and when near the point of solidification, the vessel containing them is run on rails over the moulds, which are so arranged that each frame contains 200 separate moulds, in which already the wicks, prepared with borax or a salt of ammonia, are fixed. The only remaining operation is to fill the moulds and allow the candles to cool.

Oleic acid has recently been made available for several valuable purposes; it has been largely employed in the manufacture of soap; but its most important application as yet is its use on the continent, and recently in England, as a substitute for olive oil in the greasing of wool for spinning, the advantages of which are marked, as its removal by alkalies in the scouring process is much easier, and its price lower. Messrs. Laing and Wilson have recently taken out a patent for the employment of oleate of ammonia as a mordant; and, as the specimens which I have the pleasure to show you illustrate, it increases in a marked manner the beauty and brilliancy of the coal-tar colours on cotton.

It now only remains for me to refer to another interesting process for splitting fatty matters into their elements, I mean that of Mr. Tilghman, which consists in mixing fatty matters with one-third to one-half of their

bulk of water, and placing them in a vessel capable of resisting a very high pressure. There they are submitted to a temperature of between 550° and 600° Fahr., and under the influence of that heat and pressure the fatty matters are decomposed into glycerine and fatty acids. M. Tilghman has also adapted an apparatus which enables him, by means of coils of tubes to keep up a constant stream of fatty matters and water through the tubes surrounded by fire, by which means the decomposition is rapidly and continuously carried on. I must not, however, conclude this part of my lecture without drawing your attention to these beautiful specimens illustrating the manufacture of Messrs. Price and Co., kindly lent to me by Mr. G. F. Wilson.

Spermaceti.—This valuable substance is found in large quantities in the bony receptacles of the head of the white whale of the South Seas, and as it is there mixed with a fluid substance called sperm oil, these are separated by means of filtration. The solid mass which is thereby left in the linen bags is first pressed cold, and then between heated plates (hot-pressed). It is then physicked or heated in a boiler with a solution of caustic potash of sp. gr. 1·45, which dissolves a small amount of oily matter, still adhering to the spermaceti, and this, after being well washed, is run into moulds to cool. The manufacture of spermaceti candles requires great care and practical experience. The only fact I shall mention is, that about 3 per cent. of wax is added to spermaceti to prevent the mass being too crystalline or brittle. M. Chevreul, who chemically examined pure spermaceti, or cetine, at the beginning of this century, succeeded in unfolding it into an acid, which he called ethalic acid, very similar to palmitic, and into a neutral substance called ethal, the composition of which he prognosticated would be found to contain pure alcohol. This, I am pleased to say, has proved to be the case, for its composition can be considered as represented by—

$$C_{32}\,H_{33}\,O_3 + HO.$$

Mr. Heintz has recently published a very elaborate paper on the composition of this substance, and states that spermaceti contains the following components:—

			Ethal or oxide of cetyle.
Stearophanate	$C_{36}\,H_{35}\,O_3$	...	$C_{32}\,H_{33}\,O_3$
Margarate...........	$C_{34}\,H_{33}\,O_3$	...	"
Palmitate...........	$C_{32}\,H_{31}\,O_3$	...	"
Cetate	$C_{30}\,H_{29}\,O_3$	...	"
Myristate...........	$C_{28}\,H_{27}\,O_3$	...	"
Create	$C_{26}\,H_{25}\,O_3$	...	"

It appears to me that several of these products do not exist ready formed in spermaceti, but are the results of chemical reactions.

Bees' Wax.—I have already had the pleasure, at the commencement of this lecture, of drawing your attention to the fact that bees either gather wax from the flowers on which they alight, or are capable of producing it direct from saccharine matters. The wax as it is obtained from the honeycomb being coloured it is necessary to bleach it for most of the applications which wax receives. The old process (still followed in many parts of Europe) consists in melting wax in water and allowing it to run into a second vessel so as to separate it as completely as possible from its impurities. When cooled to nearly its melting point, it is allowed to fall on rollers which revolve in cold water, by which means thin ribbons of wax are obtained, which are then placed on meadows to bleach under the influence of the atmosphere. The above operations are repeated until the wax is perfectly bleached. This plan is so tedious and expensive that several chemical processes have been proposed. Mr. Casseraud's is to pass steam through the melted mass, which is at the same time subjected to the influence of sun light. Mr. Solly's is to treat the melted wax by a mixture of nitrate of soda and sulphuric acid, when the nitric acid liberated oxidises and destroys the colouring matters of the wax. Pure wax melts at 149°, and, when treated with alcohol, is found to be composed of—

Cerine or Cerotic acid...	$C_{54}\,H_{53}\,O_3\,HO$	... 65
Myrieine	$C_{92}\,H_{92}\,O_4$	... 30
Ceroleine		... 5
		100

Sir Benjamin Brodie, who examined most minutely the chemical composition of a great variety of waxes, considers that the substance called by chemists cerine is really cerotic acid, and that myricine is a compound of palmitic acid and melissine. The lecturer here illustrated and explained the various adulterations of wax, giving the means of detecting them. The adulterations were common owing to its value.

Chinese Wax is a compact substance, imported from China and said to be secreted by an insect called *Coccus Pela sinensis.* This wax, which is harder and more brittle than bee's wax, melts at 181°, and has yielded, in the hand of the above eminent chemist, cerotic acid and cerotine or oxide of cerotyle.

Proceedings of Institutions.

BARNSLEY MECHANICS' INSTITUTE.—The Committee are grieved to report the resignation of the President, William Harvey, Esq., in consequence of his impaired state of health. The library now contains 2,190 volumes, of which 253 have been purchased at a cost of £22 1s. 8d., and 35 volumes have been given by friends of the Institute, thus making a total addition of 288 volumes during the year. The lectures have been very costly during the session, entailing an expenditure of £61 1s. 10d., an average of £5 upon each. In proportion as the members and public have appreciated the Committee's efforts to provide lectures of the best class, so has it been their desire still further to enhance the value of these entertainments. Among the lectures delivered may be mentioned one on "The study of Biography, as an aid to the work of Self-culture and the Formation of Character," by Mrs. C. L. Balfour; a dramatic reading of "The Love Chase," by Miss Kate Hickson, of the Scarbro' Theatre; one on "David Copperfield," by George Grossmith, Esq., of London; one on "Ill-used Men," by George Dawson, Esq., M.A.; one on "Albert the Good," by John De Fraine, Esq., of London. A large sum of money has been spent in the purchase of books, but the loss upon the hall account has now reached the sum of £34 16s. 9d., being more than £29 in excess of that experienced in the previous year. The lettings of the hall have only realised £25 2s., whereas in the former year they amounted to £47 6s. The balance sheet shows that the receipts have amounted to £182 3s. 6d., and there is a balance in the Bank of £31 3s.

WIGAN MECHANICS' INSTITUTION.—The tenth annual report says that although the receipts have not been equal to the expenses, considering the badness of the times there is cause for gratification at the balance remaining at the end of the year. This year voluntary donations have not been received, as was the case last year, to the amount of £28 4s. 3d. The Directors are sorry that last winter there was no inducement for them to open the evening school, this arising wholly from the fact that not more than six applications were made to join it. This can only be accounted for by the apathy of those whom the school is intended to benefit, or from the number of private evening schools now at work in the town and neighbourhood. A series of lectures was arranged to be given for the benefit of the Institution and its members, but the way in which two of the lectures were attended was far from encouraging. At the public readings the attendance and the receipts have been satisfactory. The guarantee fund against loss, given by the late Robert Laing, Esq., still remains untouched. The average number of mem-

bers paying a guinea per annum was 77; of other classes of members 249; total 326—a slight increase upon the preceding year. The library return for the year exhibits a much healthier tone of reading on the whole than for some time back, and shows an increase in the number of volumes taken out (amounting to 745) as compared with last year. The total number of books taken out in 1863 was 7,829 as against 7,084 in 1862. The expenditure amounted to £462 13s. 11d., and there is a balance against the Institution of £28 10s. 1½d.

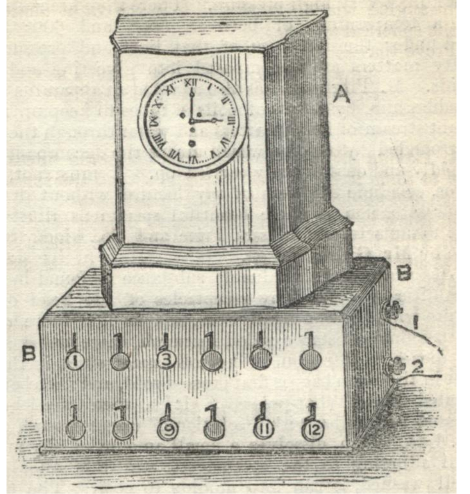
SMITH'S ELECTRIC TELL-TALE.

The ordinary tell-tale or "pin" clock, is well known for recording the vigilance of a watchman, but it can do no more than show that at a particular time the watchman was at one portion of the building. It certainly cannot inform the master whether or not the man has gone his nightly rounds as he ought. That he has been watchful and attentive at any one hour is all that one clock can prove, and the employment of two or more is rather too costly to admit of their general adoption. The accompanying engravings give an external elevation of a simple and ingenious tell-tale, invented by Mr. A.W. Willoughby Smith, and manufactured by Mr. Sax, of 108, Great Russell street, Bedford-square. The principle of its action is simply this: Suppose that in different parts of a large establishment, instead of expensive clocks, a number of old-fashioned hour glasses were placed; suppose, further, that the watchman in going his rounds should turn all these glasses during his walk at the specified period. It is obvious that, if any means could be devised by which the turning of each glass before it was run could be registered, all the purposes of the best watchman's clock would be fulfilled. This registration is exactly what Messrs. Smith and Sax effect, and the registration takes places in the head office of the firm, or any other place where it is a matter of impossibility that any tampering with the record can take place.

In each room through which the watchman has to pass in the course of his rounds is placed a small box, enclosing an hour glass, suspended on an axis through its centre, as in Fig. 2, and the watchman, by means of a key, can turn this glass over, when the sand at once begins to run. A wire connected with a clock and apparatus, Fig. 1, placed in the chief office, or other safe situation, runs from box to box, and is finally joined to one pole of a galvanic battery, the other pole of the battery being connected directly with the clock. The arrangments are such that the watchman by turning over the hour glasses establishes metallic connection all along the circuit, leaving the last connection to be completed by the clock when the hand arrives at the specified hour.

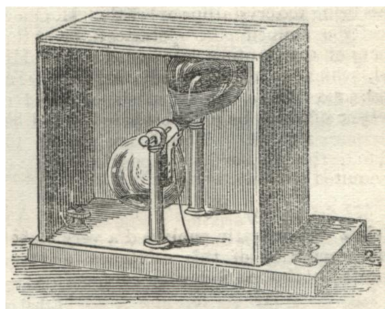
Beneath the clock is placed a stand or base, B, fig. 1, in the lower part of which are twelve apertures corresponding to the hours, marked on the dial above. In each of these is placed a small German-silver slide, marked 1, 5, 10, &c., up to 12. The clock is placed in the master's private office, and the operation is as follows:—As soon as the clock completes the circuit (which it can only do when all the hour glasses are standing as set by the watchman) a temporary magnet is formed which causes one of the labels to drop into view as the hour-hand of the clock reaches each figure on the dial; but as the circuit cannot be completed by the clock unless the hour-glasses, which are shut up in locked boxes, are turned regularly, the neglect of any one hour is registered by the non-descent of the corresponding label. It matters not if out of 20 glasses 19 are in contact. The failure of the 20th is inevitably registered. The sand in the glasses is adjusted to run out in a given period, say half an hour, or such length of time as will enable the watchman to make his round and turn each hour-glass, and admit of the clock reaching the given hour before the sand has run out, and the glasses overturned, by change in the position of

FIG. 1.



their centre of gravity, thus breaking the continuity of circuit.

FIG. 2.



If the wires are tampered with, a bell is set ringing in the office, until attention is attracted and the wires set right.

When desirable, alarums can be rung at various hours, or at the same hour in many different rooms by the same clock. Thus, if need be, an entire village of factory operatives might be aroused betimes. It is evident that this electrical tell-tale is applicable to a vast number of purposes. It can be used on board ship; at railway stations it can report the vigilance of outlying signal men. In fire-engine stations, breweries, factories, mills, docks, or warehouses, it appears likely to prove equally suitable.

EXAMINATION PAPERS, 1864.

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April last:—

(*Continued from page* 591.)

NAVIGATION AND NAUTICAL ASTRONOMY.

THREE HOURS ALLOWED.

I.

1. Prove that the sum of the angles of a spherical triangle is greater than two and less than six right angles: also, if A B C be the angles of a spherical triangle, $A + B - C < \pi$

2. Express the Cosine of an angle of a spherical triangle in terms of the sines and cosines of the sides, and deduce the formula,

$$\text{Cot. } a \text{ Sin. } b = \text{Cos. } b \text{ Cos. C} + \text{Sin. C Cot. A.}$$

3. What is meant by the Spherical Excess? In any right-angled triangle of which C is the right angle and E the spherical excess,

Prove that—

$$\frac{\text{Sin.}^2 c}{\text{Cos. } c} \text{ Cos. E} = \frac{\text{Sin.}^2 a}{\text{Cos. } a} + \frac{\text{Sin.}^2 b}{\text{Cos. } b}$$

II.

1. Having giving two sides and the angle opposite to one of them in a spherical triangle, to find the remaining parts, and explain the ambiguity in this case.

2. Shew how to reduce an angle to the horizon.

3. Find the angular radius of the circle which touches three sides of a given triangle in terms of its sides or angles.

III.

1. February 18th, 1864, the observed meridian altitude of Canopus under the South Pole, was 33° 20′ 30″. Index error — 1′ 40″, and the height of the eye 19 feet. Required the latitude.

2. September 18, 1864, at 5h. 51m. A.M., nearly in latitude 47° 25′ N., longitude 120° 30′ W., the sun rose by compass E. 12° 10′ S., the ship's head being E. Required the variation of the compass. The deviation is 8° 50′ E.

IV.

1. Prove that—

$$\frac{\text{Diff. latitude.}}{\text{Mer. diff. lat.}} = \text{Cos. Mid latitude.}$$

2. In Great Circle sailing show how to find the distance in a great circle between the places whose latitudes and longitudes are given.

3. Prove the rule for computing meridional parts.

V.

1. Required the compass course and distance from A to B:—

Lat. A 45° 20′ N. Variation 2 Pts. E., lon. A 3° 10′ E.
„ B 39° 30′ N. Deviation 7° W. „ B 2° 20′ W.

2. Sailed from a place A, due West, 471·5 miles, to a place B. Required the latitude and longitude B.

Lat. A = 50° 20′ N., lon. A = 5° 18′ W.

3. A ship having sailed N.E. by E. from a port in latitude 42° 18′ N., met a sloop which had sailed from a port in the same latitude, lying 92 miles to the east of the ship's port; the sum of their distances made is 159 miles. Required their respective courses and distances.

VI.

1. What is meant by *equation of time?* and explain the causes which affect its nature and amount. What is meant by the hour angle of a heavenly body?

Also find the hour angle of a heavenly body east of the meridian, given the latitude 47° 38′ 10″ N., the declination = 13° 25′ 33″ S., and the altitude 50° 16′ 34″; and construct the figure.

2. May 16, 1864, at 6 A.M., nearly in latitude 42° 37′ N., lon. 115° 30′ W., the obs. alt. of sun's L.L. p. artificial horizon, was 27° 55′ 15″. Index error + 3′ 12″. The chronometer showed 2h. 8m. 50.5s. Required the error of the chronometer or Greenwich meantime.

VII.

1. Investigate a method of finding the latitude and longitude by means of two altitudes of a heavenly body and the run between.

2. Describe and prove Sumner's method of finding the latitude and longitude by a double altitude of the sun.

3. The distance of a heavenly body from the moon being observed, and their altitudes show how to find the true distance and the longitude of the place of observation.

VIII.

1. Explain the mariner's compass. Show to what several sources of error it is liable, and how these may be corrected.

2. Explain fully how azimuths of a heavenly body are observed.

3. What is meant by a cyclone? What is the difference between a cyclone in the northern and southern hemisphere? Show how to find the bearing of the centre of a circular storm.

PRINCIPLES OF MECHANICS.

THREE HOURS ALLOWED.

1. What are the principal properties of matter?

2. Three forces act on a material particle in directions at right angles to each other: it is required to find the magnitude and direction of their resultant.

Ex: Let the forces be denoted by 6, 9, 10; what are the direction and magnitude of the resultant?

3. Define the centre of gravity of a heavy body, and prove that if a body be suspended from a point about which it can swing freely, it will rest with its centre of gravity in a vertical line through the point of suspension.

Where is the centre of gravity of a triangle of which each side is a foot long?

Two spheres, whose radii are 8 and 10 inches, touch one another: determine the distance of the centre of gravity from the centre of the smaller sphere, when the former is of copper and the latter of iron.

(Sp. G. of copper = 8·788: Sp. G. of iron 7·207.)

4. What are the two requisites for a good balance? Show how they can be obtained. Which of the two requisites is the more necessary for rough work, and which for delicate weighing?

5. A body is thrown vertically upward with a given velocity: investigate the formulæ for the space described in a given time.

Ex. Let the upward velocity of projection be 100 feet: how high will the body have risen in three seconds? How high altogether? How long will it be before it returns to the starting point?

6. What are the laws of impact of two bodies, whether elastic or inelastic? If two inelastic bodies impinge upon one another, determine their common velocity after impact.

A, weighing 2 lbs., and moving with a velocity of 20 feet per second, overtakes B, weighing 5 lbs., and moving with a velocity of 5 feet per second: determine the common velocity after impact.

If A and B be each perfectly elastic, determine their separate motions after impact.

7. Prove that the curve described by a projectile in vacuo is a parabola.

There is a wall 20 feet high: from a point 16 feet on one side of the base a body is thrown so as just to clear the wall, and to fall 30 feet on the other side of the base: with what force, and in what direction, must the ball have been sent?

8. A heavy body moves in a circle with uniform velocity: find the central force necessary to keep it in the circle.

A locomotive engine, weighing 9 tons, passes round a curve 1,200 yards in radius at the rate of 20 miles an hour: what is the pressure tending away from the centre of the curve?

9. What is the "radius of gyration" of a body round a fixed axis? Find that of a fly-wheel, the inner and outer diameters of whose rim are 15 and 16 feet respectively, around its shaft.

10. State and prove the amount of pressure of a fluid on a surface containing it.

Ex. 1. Find that on the surface of a sphere of 10 inches radius filled with water.

Ex. 2. A reservoir has a bank whose inner slope is 90 feet by 100 yards; when full the depth of water is 80 feet: find the pressure on the embankment, and where the direction of the resultant acts.

11. How is sound produced? What are the experimental facts ascertained with regard to the waves of sound?

12. Explain the action and the defects of the wheel barometer.

13. Describe and explain the facts of capillary attraction; and prove that the form of a fluid, ascending between two vertical plates slightly inclined, is a hyperbola.

(*To be continued.*)

Manufactures.

Wolframed Pig Iron.—The *Colliery Guardian* gives an account of some experiments made by M. Le Guen with reference to the advantages derived from a mixture of wolfram with iron. The experiments took place at the military port of Brest, and the pig tested, which comprised both new and old specimens in proportions adapted to give them a great resistance, acquired a new degree of strength by an addition of less than 2 per cent. of wolfram. One description of pig which was experimented upon was formed of equal parts of new English pig, Yféra-anth, and old speckled pig, and the augmentation of resistance to a rupture, after the addition of French wolfram, was 44½ kilogrammes per square centimetre. A kilogramme is the fiftieth part of an English cwt.; and a centimetre is the hundredth part of a metre, or about four-tenths of an English inch. In another description of pig, formed of one-third of the same English pig and two-thirds of the fragments of old cannons, the augmentation of resistance with German wolfram, put in in the same proportion, was about 68 kilogrammes per square centimetre. On being submitted to a second fusion, the wolframed pig still preserved its superiority over corresponding ordinary pig. After this operation, the difference in favour of the first pig with wolfram was 26¼ kilogrammes, rather less than in the first instance; but the difference in favour of the second description was 69 kilogrammes and a fraction. Thus the efficacy of the German wolfram, already greater at the first fusion than that of the French wolfram, still remained superior to it in the second fusion. A third fusion of the same pig having been effected—this time directly in a Wilkinson's furnace, instead of in a melting pot or crucible, as formerly—the tenacity of the wolframed pig again exceeded that of the corresponding pig. It may be concluded from this that the action of the wolfram continues when the fusion is taking place directly in a furnace, and that it is maintained after several successive fusions. In wolframed pig, composed of Yféra-anth and fragments of old cannons, resistance to rupture after the second fusion exceeded, by nearly one-third, that of ordinary corresponding pig. The resistance of the same pig after the first fusion exceeded, by 20¾ kilogrammes per square centimetre, that of the most tenacious pig dealt with formerly in the foundry of the port of Brest; and after a second fusion it exceeded by 42 kilogrammes. It is sufficient that the wolfram should be pulverised but not reduced. The French mineral is, however, roasted besides, so as to free it as much as possible from the sulphur and arsenic which it contains. As to the German wolfram it was simply pulverised in the experiments at Brest, and it had not undergone any preparation, being probably more pure. The reduction is effected in the midst of the liquid mass, at the expense of the carbon of the pig.

African Exhibition.—In the month of December next there will be held, at Freetown, Sierra Leone, an exhibition of native art manufacture, agriculture, live stock, and produce; with departments for European and other foreign exhibitors. The project enjoys the patronage of the Governor-in-Chief, Major Blackall, who is also the president; the Governor of Gambia, Colonel D'Arcy, Commodore Wilmot, members of the Legislative Council, and so forth. Contributions and assistance from England are desired, and arrangements for the free conveyance of goods to and from the place of exhibition will be made with the African Mail Steam-ship Company. In the meantime subscriptions in aid of a movement so eminently calculated to stimulate the producing powers of the colony will be received at the London and Westminster Bank, St. James's-square.

Bisulphate of Carbon.—M. Deiss, one of the largest manufacturers of bisulphate of carbon in France, has invented an apparatus containing hydrate of lime, which absorbs the waste sulphuretted hydrogen given off during the process. At the suggestion of M. Payen, M. Deiss has substituted for the lime sesquioxide of iron mixed with sawdust. The products resulting are water and sulphur, the latter being recovered by simple washing with bisulphide of carbon and subsequent distillation. The oxide of iron is then calcined, and is once more ready for use. The idea has, of course, been taken from the method of gas purification, now adopted by many companies, but the application is new.

Commerce.

Culture of Cotton in Algeria.—Great efforts have been and are still being made to establish the cultivation of cotton firmly in Algeria, and a report lately published on the success that has been obtained in the province of Oran speaks of the results in highly satisfactory terms. The number of persons engaged in growing cotton is stated at 557, and the extent of the plantations at about 6,332 acres, of which all, with the exception of 187 acres, are planted with long Georgian cotton. The average yield of this kind is set down at more than 531 kilogrammes per hectare, or over 500lbs. English per acre, while in many places the yield has been as high as 700 kilogrammes. The short fibre cotton yielded only 427 kilogrammes per hectare. The total crop of cotton, uncleaned, was 1,338,103 kilogrammes, or 1317 tons English. This shows an increase of two-thirds over the year 1862. The yield of the cotton after cleaning is stated to be 25 per cent. The amount exported, and on which the government premium was paid, is stated to have been 3,193 bales, giving a total of about 312 tons. The report recognises great improvement, not only as regards the cultivation but also in the preparation of the cotton, the ginning, and the making up of the bales. The sorting, however, is spoken of as much less satisfactory. The reporters express their opinion that in a few years the average yield of 600 kilogrammes per hectare will be attained, and perhaps surpassed. As regards the price of cotton in France, to the 15th of May, the average, at Marseilles, was 1025 fr. the 100 kilogrammes (about 3s. 2d. per lb. English); at Havre, 1080 fr.; at Lille, 1040 fr.; and at Mulhouse, 978 fr. The Chambers of Council of these four towns have been consulted on the probabilities of the maintenance of the price, and their answers are as follows: The Marseilles Chamber is of opinion that there is no hope of such prices being obtained; that of Havre, that there is every reason to suppose that the present prices will be maintained without sensible variation, unless unforeseen circumstances arise; Mulhouse thinks that the price of Algerian cotton has already begun to waver, that it is now 9fr. 50c. per kilogramme, but that that is not a natural price, and that if Algeria hopes to participate largely in the demand her price must not surpass 8 francs per kilogramme for long-fibre cotton; Lille says that the question is a difficult one to answer, and the price must depend on the supply from America. The diversity of opinion between the Chambers of Commerce of Marseilles and Havre is remarkable.

Colonies.

The New Zealand Exhibition.—A photograph of the building intended for this Exhibition, erected at Dunedin, Otago, from the designs of Wm. Mason, Esq.,

architect, one of the Commissioners, shows that it is a handsome building, with two wings. The central portion is already completed and roofed in. The Exhibition bids fair to be a decided success, for the British and Foreign exhibitors who have already had space allotted to them will cover an area as large as that given to all the British colonies in the Exhibition of 1862, viz., 10,000 net superficial feet—besides between 4,000 and 5,000 feet of wall space. Our manufacturers, although at first a little apathetic, have gradually taken a more earnest interest in the undertaking, and Halifax, Leeds, Bradford, Sheffield, Birmingham, Glasgow, London, and many other of the principal towns will be well represented. Such persons as Messrs. Shand, Mason, and Co.; Messrs. Broadwood and Sons; S. W. Silver and Co., Jennings, and others of London; John Crossley and Sons, and H. C. M'Cree and Co., of Halifax; Spear and Jackson, Robert Sorby and Co., and all the leading firms of Sheffield, besides many other well-known manufacturers of agricultural implements and machinery all over the country are exhibitors, and our manufactures are likely to be creditably represented. The Indian Board send out a very fine collection of raw produce and manufactures of the East; and the Department of Science and Art are also exhibitors. The Commissioners report that they were in the receipt of very encouraging accounts from all parts of New Zealand and Australia. The Commissioners have arranged for the publication of a series of very valuable essays by some of the ablest men in New Zealand, under the editorship of Dr. Hector. The following are the subjects:—I. *History*—1. "On the Native Races," by Dr. Shortland, of Auckland. 2. "On the Province of Auckland (unassigned). 3. "The Provinces bordering on Cook's Straits, Wellington, Nelson, Taranaki, Hawke's Bay, and Marlborough," by F. Dillon Bell, Esq. 4. "On Canterbury," by J. E. Fitzgerald, Esq. 5. Otago and Southland, by W. H. Critten, Esq. II. *Statistics*—1. "Commercial, Pastoral, and Agricultural," by the Chambers of Commerce. 2. "Vital Statistics" (unassigned). 3. "On the Diseases of New Zealand," by Mr. Hocken. 4. "Gold Mining Statistics, and History of the Gold Fields of New Zealand," by Vincent Pyke, Esq. III. "*Meteorology* of New Zealand," by Dr. Knight, Auckland. IV. *Geology*—1. Of the North Island, by the Hon. J. Crawford. 2. Of Nelson and Canterbury, by Dr. Haast. 3. Of Otago, by Dr. Hector. 4. "Mineralogy and Mining of New Zealand," by J. R. Hackett, Esq. V. *Botany* (Geographical and Economic)—1. Of the North Island, by Mr. Colenso. 2. Of the South Island, by Dr. Munroe. VI. *Zoology* of New Zealand and the neighbouring seas, by the Rev. R. Taylor. These essays, from the pens of thoroughly competent men, will bring together a mass of recent authentic information respecting the colony which will be of great value alike in a scientific, commercial, or colonial point of view. The Commissioners are securing the services of a competent engineer from Melbourne to conduct the experiments for testing the strength of materials, which they propose carrying out.

A Nelson paper says, that at last there is a chance of a trade with Melbourne being opened up, a company having been formed at Dunedin to work two steamers between Melbourne and the ports of the Southern Island, calling at Wellington. At present communication with Melbourne is so uncertain that many orders which would be sent there are sent to Sydney instead.

Resources of Otago.—A local journal says that Otago possesses a population of sixty thousand, altogether untaxed except through the customs revenue. This population is not of a pauper class; there are no poor-houses, and a professional beggar is a rarity. It is, in short, a wealthy population. The earnings of all classes of the community are far in excess of those of persons in the same position and with the same capital at home. Here is a population then ready and able to be taxed, if taxation be necessary to meet its engagements. But what need of taxation? It is magnificently endowed with a public estate set apart to meet its liabilities. The unsold lands of each province belong to it, and the assembly has recognized the principle, though it is not yet embodied in statutory form, that the land may be offered as a first security to creditors of the province. According to a return laid on the table of the council last session, the land available for immediate sale was 600,000 acres. There were besides over six millions of acres under pastoral lease, any portion of which could, by proclamation, be withdrawn from occupation and offered for sale. The new land act passed last session is expected to come immediately into force. It proves that the upset or lowest price at which land can be sold is £1 per acre, with an additional payment of 2s. per acre per annum until improvements, to the amount of £2 per acre are effected. With regard to land occupied for pastoral purposes, the occupiers were the pioneers of the country, and the encouragement was naturally given them of short leases at trifling rates. These leases will fall in the course of a few years, and the land will be available for re-letting. It is impossible to conjecture the price it will fetch, but something very high may be counted on. Land not particularly good, or very favourably situated, produces a rent of from 6d. to 8½d. per acre per annum. When the leases fall in, and more favourable terms can be offered to occupiers, the rents will yield to the province a magnificent income. Then there are the gold fields; these have been sufficiently proved to show they cannot be worked out for many years. The rivers indeed will be inexhaustible; every flood brings down fresh deposits. On every ounce produced, 2s. 6d. is paid to the state for export duty. This also is available to the use of the province. Otago has received during the last two years and a half from this source, £182,000.

Border Customs in Australia.—This question is likely to create some correspondence between the three governments interested in the navigation of the Murray. New South Wales favours a protectionist policy, while Victoria raises her customs revenue from a few articles only, that as few restrictions as possible may be placed on the freedom of trade. The whole of the commerce of the Riverina district of New South Wales, large and rapidly growing as it is, has passed of late years into the hands of Melbourne. The approaching completion of the Victoria Railway to the banks of the Murray, and the steps now being taken to facilitate the navigation of the Upper Murray and its tributaries, for which £10,000 has been voted, have awakened the New South Wales government to their interests in the district in question. They propose that Victoria should collect the dues for them that their tariff imposes upon goods entering Riverina by way of Victoria, in addition to those which are collected at Melbourne under the imposts of the government there. This the government declines to do, and the government of South Australia, which for a length of time served the Sydney government in this matter, now refuses to continue to do so unless Victoria collects also. To facilitate the collection of Riverina dues, a border customs' bill has been lately passed by the Sydney government; a custom-house is to be built, and a number of officers will be spread along the north bank of the river. There is no disposition on the part of the people of Riverina to pay double duties, and as the politicians of Sydney are unwilling to adopt the free trade doctrines popular in Victoria, an extensive system of smuggling on the borders seems not improbable.

The Victoria Vintage is expected to be poor; a wet spring, with its accompaniment, the blight, so destroyed the vine blossoms that in some vineyards the berries on the plants could almost be counted at a glance. The cool summer again so retarded the ripening of the fruit, that in some places the vintage is five or six weeks behind time. More recently the heavy rains played serious havoc just as the fruit was ready for gathering. Under these adverse circumstances the vintage promises to be the lightest this colony has had for years

TOBACCO AT THE CAPE.—Mr. T. Gurney Hawes, in a letter to the secretary, dated Mossel Bay, Cape of Good Hope, June 16th, 1864, says:—"I notice, in the Society's *Journal* of the 29th April, a paragraph relative to the growth and preparation of our colonial tobacco, in which great credit is awarded to the Eastern Province for its energy and perseverance, as exemplified by the fact of Mr. Rautenbach having obtained the prize for that article at the agricultural show at Humansdorp. I would wish, however, due justice to be done to our Western Province, which although, as truly stated, composed chiefly of Dutch inhabitants, who are very loth to depart from the customs of their ancestors, has shown far more energy and determination to succeed in the manufacture of tobacco than our eastern friends. To Mr. Powrie, of this village, was awarded the first prize for Cavendish and leaf tobbacco, cigars and snuff, at the agricultural show held at Swellendam this year, and he also obtained similar reward for his Cavendish and "golden leaf" exhibited at the show held at Uitenhage, in the Eastern Province. Since then a very spirited and well-directed effort has been made by two gentlemen, also residents here; they intend not to prepare the tobacco as at present produced by the farmers, who know nothing of the proper method of treating the leaf after it has been gathered, but, commencing at the first step, have laid under cultivation a large tract of moist fertile soil near George Town, the whole being under the charge of an American gentleman, well acquainted with all the details of its growth and preparation. The seed is already in the ground, and we confidently look forward to the time when not only will it be unnecessary to import tobacco from America, but when Mossel Bay will become the seat of a large export trade."

Obituary.

RODOLPHE WAGNER.—The University of Gottingen has lost one of its most distinguished professors by the death of Rodolphe Wagner, after a long and painful illness. M. Wagner was born in 1805, his father having been rector of the Protestant Gymnase of Augsbourg, where the son received his early education. Louis Napoleon was afterwards at the same school, under the tutorship of the elder Wagner. Rodolphe Wagner studied medicine at Erlangen and Wurtzbourg, and became doctor at the age of twenty-one. In 1827 he was in Paris studying under Cuvier, and he afterwards devoted himself to comparative anatomy. After leaving Paris he explored the coasts of Normandy, of the south of France, and of the Island of Sardinia, where he discovered an important deposit of fossil bones. Returning to Germany he established himself at Augsbourg. In 1829 he was attached to the University of Erlangen as anatomical preparator, and in 1832 he became professor of zoology in the same establishment. From 1832 to 1840 he published several works, which attracted the attention of the scientific world; amongst these were:—"Study of the Blood," "A Treatise on Comparative Anatomy," and another on "Comparative Physiology." On the death of the celebrated physiologist, Blumenbach, Wagner was elected to the professorship thus rendered vacant in the University of Gottingen, where he remained till his death. In 1845 and 1846 he went to Italy for his health, which had long been failing, and it was there that he conducted a series of valuable experiments on the electric organs of a fish belonging to the skate tribe. He was the author also of many other publications on pure and comparative anatomy, zoology, and anthropology; amongst others a "Dictionary of Physiology," "A Memoir on the Structure and Termination of the Nerves" (1818), and "Researches in Neurology" (1864). M. Wagner was one of the most eminent representatives of the scientific spiritualists of Germany. His studies on the brain, as the organ of intelligence, tend to throw a doubt over the supposed connection between the amount of intelligence and the volume of that organ. At the thirty-first congress of naturalists, in 1854, a very lively dispute arose on that and cognate questions between Wagner and Fichte, on the one part, and Vogt and Moleschott, on the other; the discussion was maintained with great ardour, and created an immense sensation, which lasted for years, and gave rise to an immense mass of publications *pro* and *con*. A work entitled "Zum Streit über Leib and Seele," which appeared at Hamburg in 1856, consists principally in a resumé of this famous discussion. In 1862 Wagner published two important memoirs on anthropology, in which the relation of the brain to the mind is treated at great length; this gave rise to a long and brilliant series of discussions in the Anthropological Society, in which M. Gratiolet and M. Broca bore prominent parts.

Notes.

UNIVERSAL AGRICULTURAL EXHIBITION IN ALGERIA.—This exhibition, which is held alternately in the three provinces of Algeria, opens at Oran on the 24th of September, and will close on the 2nd of October. A sum of 30,000 francs is voted for the prizes to be awarded. All exhibitors not of the colony will have to transport their produce or implements to the port of Mers-el-Kébir, at their own cost, but the railway and steam navigation companies have fixed a low tariff of charges for the special case; the Algerian Government will convey everything admitted for exhibition from the above-named port to Oran at its own charge. Exhibitors will be conveyed from the French or other coasts to Mers-el-Kébir free of charge. Algeria has become a regular place of resort for valetudinarians, and there such exhibitions as these, and the increasing cultivation of cotton, will probably draw other classes towards that curious country.

THE EFFECT OF LIQUID IN PRODUCING FATNESS.—Much has been said of late concerning the effect of various kinds of diet on the condition of the body, and especially upon the production of fat; and M. Darcel, of Paris, has just added a valuable chapter on the subject. He says that, during a long course of experiments and observations relative to the reduction of obesity in man, he has remarked that those who have carefully abstained from the use of fatty and fat-producing articles of diet have not diminished in weight while they continued to drink large quantities of liquid. Hence he was led to the belief that water and aqueous substances favoured fatness. Water, he believes, plays a great part, and he expresses his surprise that, in the numerous experiments made on animals, this element has been almost entirely disregarded. In the Garde de Paris there was a horse remarkable for its leanness, and, at the instance of M. Darcel, M. Decroix, the veterinary-surgeon of the regiment, made the following experiment:—He reduced the animal's ration of oats, without diminishing the regular quantity of straw and hay, and gave him as much water as he would like to drink with a little bran in it, amounting to about a pound of the latter per diem. At the end of May last, the horse weighed 512 kilogrammes; on the 17th June, 530 kilogrammes; an increase of 18 kilogrammes (nearly 40 lbs. English) in 17 days, for which the pound of bran, substituted for three pounds of oats, could not alone account. In the same regiment was another horse which was so fat that it suffered severely under its work. This horse consumed 60 litres of water a day; this was at once diminished to one-fourth; the horse soon began to lose its fatness, acquired activity, and performed its work without any of the symptoms of distress which it had formerly exhibited.

AN OLD WATER-WHEEL.—A wheel, composed entirely of wood, down to the very treenails, as a sailor might say, was found some time since in the mines of Saint Columbo, in Portugal. This wheel was employed to pump the water out of the mine, and is believed to have

been constructed by the Romans during their occupation of Portugal, that is to say, about the year 412 of our era, or upwards of 1,400 years ago. The wheel is still in fair condition, and it is said that it will probably be placed in the Conservatoire des Arts-et-Métiers, in Paris.

Proposed Bridge over the Straits of Messina.—The Italian engineers have announced a project of bridging over the straits that divide the island of Sicily from the main land. The plan proposed is a new form of suspension, the chains to be of cast steel, and the structure of sufficient strength to bear the strain of many railway trains at a time.

Fish Preserves in France.—There is a small fishing town on the coast of Brittany called Concarneau, in a secluded bay surrounded by hills, well wooded to the water's edge. Fish preserves have here been blasted out of the solid granite rock, leaving strong walls of granite to resist the action of the waves. The superficial area thus enclosed is 1,000 square metres, and is divided into six basins, which the water enters at high tide twice a day, passing out at low-water through openings with gratings, or not, as may be thought desirable. All kinds of fish which are caught on the coast of Brittany are received into these basins, where they live as they would in the sea. There the turbot may be seen, with his mouth opening like that of a snake to take his prey, enjoying himself by the side of the sole and the plaice, which lie immoveable, in colour like the bottom on which they rest. There also may be seen shoals of mullet feeding on the seaweed, the red mullet seizing, with his two feelers like delicate fingers, the food he devours; the skate threading his way through the water, using his fins as a bird does its wings, the gurnet stretching in the sun his brilliant pectoral fins, glistening with colours as rich as those of the butterfly; the John Dory moving with solemn pace, using his dorsal fin like a screw propeller; the conger hiding himself behind the rock, watching for his prey; the sardine darting in every direction, his presence manifested by the blue tints of his back, and only escaping his numerous enemies by the rapidity of his movements, calling to mind the peculiar flight of the swallow. In a very few days the fish become domesticated and sufficiently tame to eat out of the hand. Guillou, an old pilot, who has the care of the preserves, has taught two congers to pass through his hands when he calls them. In these basins the fish grow rapidly; turbots especially. The basins for the crustaceans are divided into three compartments, in two of which are from 1,000 to 1,500 crawfish* (*langouste*) and obsters, living in captivity with no serious amount of mortality, fed upon fish of no value, or the heads of the sardines, which are thrown aside when preserving this fish in oil. They may be seen flying from the light and hiding themselves under the shelter prepared for them. The lobsters move but little, and lie hid under stones or in hollows of the rocks. The crawfish, on the contrary, are more active, and are always climbing about, snapping up a sardine in a moment. These crustaceans too, are very fond of the star-fish. Star fish as large as 20 centimetres in diameter, when thrown in are seized at once, five or six of the craw-fish fastening on each finger, breaking off a piece, and rushing away with it to eat at their leisure. They are also very fond of mollusks. The jaws of the craw-fish are so formed as to be able to penetrate the shell of the oyster, and get at the animal himself, which is a very favourite food. These breeding basins become actual nurseries for restocking the sea with fish. They have succeeded in bringing up young lobsters, even to the twentieth casting of the shell, that is, for four years. It is only about the fifth year that the lobster acquires his legal size of 20 centimetres in length. The system is being extended, and preserves of this kind for fish crustaceans and mollusks are being established on various parts of the shores of France. The most remarkable of them is that of Cresoles, on the Ile de Tudy. It covers 70 hectares, and at this time contains 75,000 crawfish. Thus the original establishment, by Pilot Guillou, of this fish preserve (a sort of aquatic farm-yard) has become the signal for the creation of new industries, which provide not only in themselves an increase in production of food, but aid materially in turning the sea to account and increasing its productiveness.

* Not the small common crawfish (*écrevisse*) which lives in the fresh waters, but a large lobster-like animal often 18 inches long, and weighing as much as twelve or fourteen pounds. It is esteemed a great delicacy, and a delicious soup is made from it at Marseilles and all along the Provence coast, very much richer than the well-known *potage d'écrevisse.*

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 18th and 20th June, 1864.*

154. „ Cranbourne Street.
156. „ Countess of Elgin and Kincardine's Annuity.
160. „ Judgments, &c., Law Amendment (amended).
162. „ Divorce and Matrimonial Causes (Amendment).
159. „ Inland Revenue (Stamp Duties).
Statistical Abstract for the United Kingdom (1849 to 1863).
Anderson, The Rev. F.—Papers relative to the Arrest of.
Prussia—Convention for the Mutual Surrender of Criminals.
Russia Company—Correspondence.

Delivered on June 21st, 1864.

331. Tasmania (Van Diemen's Land)—Report of Mr. Gould.
378. Metropolitan Subways Bill—Report.
398. Army Clothing Factories (Woolwich and Pimlico)—Return.
161. Bills—Scottish Episcopal Clergy Disabilities Removal.
150. „ New Zealand (Guarantee of Loan).

Delivered on 22nd June, 1864.

274. West India Mails—Extracts of Correspondence.
408. Navy ("Ship Research")—Additional Official Correspondence
Education—Minute of 11th June, 1864.

Delivered on 23rd June, 1864.

389. Lunacy—Eighteenth Report of Commissioners.
391. National Education (Ireland)—Circular of Instructions.
395. Case of Mr. Bewicke—Report, Evidence, &c.
155. Bills—Local Government Act (1858) Amendment.
163. „ Contagious Diseases.

Delivered on 24th June, 1864.

411. Army (Small Arms)—Return.
164. Bills - Sheriffs Substitute (Scotland).
165. „ Weights and Measures (Metric System) (amended).
166. „ Indian Office.

Delivered on 25th and 27th June, 1864.

373. Thames Conservancy Bill—Report, Evidence, &c.
403. West Riding of York Assizes—Order in Council.
62 (vi.) Committee of Selection—Seventh Report.
396. Judgments, &c. Law Amendment Bill—Report, Evidence, &c.
419. Vessels and Tonnage, &c.—Return.
425. Metropolitan Railways—Return.
167. Bills—Penal Servitude Acts Amendment (Lords Amendments).
168. „ Public Schools.
170. „ Inclosure (No. 2).
169. „ Mortgage Debenture.
172. „ Weighing of Grain (Port of London) (amended).

Delivered on 28th June, 1864.

376. Royal Mail Steamer "Africa"—Evidence.
394. Prison Ministers' Act (Middlesex)—Correspondence.
407. School of Naval Architecture—Correspondence.
412. Army (Manufacturing Departments, Woolwich and Enfield)—Comparative Prices.
421. Removal of Paupers—Return.
173. Bills - Railways (Ireland Acts Amendment (amended).
174. „ Ecclesiastical Courts and Registries (Ireland).
Denmark—Protocols of Conference held in London.
North America (No. 15)—Papers respecting the Arrest and Imprisonment of Mr. J. McHugh.

Delivered on 29th June, 1864.

413. Captain Wolfe de Carvel—Correspondence.
420. Exports and Imports—Return.
432. Malta New Dock—Letter, &c.
176. Bill—Registration of Deeds (Ireland).

Delivered on 30th June, 1864.

66 (v). Trade and Navigation Accounts.
348. Belfast Improvement (No. 2) Bill—Minute of Evidence.
414. Dublin Corporation (Bills in Parliament)—Return.
426. Portpatric Harbour—Return.
427. East India (Officers)—Despatch.
433. Joint Stock Companies—Return.
434. Medical Degrees—Return.
440. Thames Embankment—Letter.

171. Bills—Harwich Harbour Act Amendment.
177. „ Highways Act Amendment (amended).
179. „ Administration of Trusts (Scotland) (amended).

Delivered on 1st July, 1864.

401. Sioux Indians—Extracts of Correspondence.
402. Canada and Pacific Telegraph—Extracts of Correspondence.
417. Carlisle Cathedral—Return.
418. East India (Lieut. Bartholomew)—Correspondence.
429. East India (Civil Appointments)—Return.
447. George O'Malley Irwin—Letter.
448. Law Courts Concentration—Treasury Minute.
175. Bills—Cattle Diseases Prevention (amended by the Select Committee).
181. „ Bleaching and Dyeing Works Acts Extension.
182. „ Election Petitions Act (1848) Amendment.

Delivered on 2nd and 4th July, 1864.

383. Turnpike Trusts—Report, Evidence, &c.
420. Exports and Imports—Return (corrected copy).
432. (I). Malta Dock—Letter.
435. Epping Forest—Letter.
404. Whitwick Reformatory—Report.
422. Clonmel (Ireland) Lunatic Asylum—Correspondence.
423. Standing Orders (Parliamentary Deposits)—Report, Evidence, &c.
442. Royal Naval Reserve—Return.
450. Saltpetre, &c.—Account.
138. Bills—Justices of the Peace Procedure.
183. „ India Stocks Transfer Act Amendment.
185. „ Isle of Man Harbours Act Amendment.
188. „ Courts of Justice Money.
189. „ Courts of Justice Site.
Chincha Islands—Papers relating to seizure by a Spanish squadron.
Denmark and Germany (No. 6) 1864—Correspondence.

Delivered on 5th July, 1864.

415. Isle of Man—Returns.
428. Isle of Man Lunatic Asylum—Correspondence.
428 (I). Isle of Man Lunatic Asylum—Letter.
437. Constabulary (Ireland)—Statement.
445. Registration of Deeds (Ireland)—Account.
178. Bills—Naval and Victualling Stores (amended).
180. „ Gaols (amended).
184. „ Pilotage Order Confirmation (No. 2).
186. „ Street Music (Metropolis) (amended).
187. „ Improvement of Land Act (1864).
130. „ Criminal Justice Act (1855) Extension.
Denmark and Germany—Letters respecting the Summary of the proceedings of the Conferences on Danish Affairs, annexed to 22th Protocol.

Delivered on 6th July, 1864.

997. Arms, &c.—Returns.
400. Custom Duties (Canada)—Correspondence.
438. Roehampton Gate (Richmond Park)—Correspondence.
451. Bankruptcy—Return.
454. Dockyards and Steam Factories—Return.
Ionian Islands—Correspondence respecting the Cessation of the British Protectorate over those Islands.

Delivered on 7th July, 1864.

379. Metropolis Local Management Act—Return.
387. Grain and Corn—Returns.
439. Navy (Masters, &c.), Navy (Officers)—Returns.
453. Postage (Australia)—Correspondence).
456. Banda and Kirwee Booty—Terms of Reference.
191. Bills—Thames Embankment and Metropolis Improvement (Loans).
192. „ Poisoned Flesh Prohibition, &c.
194. „ Turnpike Acts Continuance, &c.
Science and Art Department—Eleventh Report of the Committee of Council on Education.

Delivered on 8th July, 1864.

367. Transatlantic Steamers—Return.
441. Copyright (No. 2) Bill—Report, Evidence, &c.
125. Bill—Trespass (Ireland) (amended).

Delivered on 9th and 11th of July, 1864.

55. (viii). Railway and Canal Bills—Ninth Report.
424. River Niger—Correspondence.
459. Expiring Laws—Report.
460. Brandy—Returns.
464. Exchequer Bonds—Account.
465. Army (Officers and Men Drowned)—Return.
370. Finance Accounts (I to VII).
461. Education (Ireland)—Annual Report.
462. Unclaimed Wreck—Returns.
196. Bills—Turnpike Trusts Arrangements.
198. „ Joint Stock Companies (Voting Papers) (amended).
193. „ Expiring Laws Continuance.
197. „ Ionian States Acts of Parliament Repeal.
Russia Company—Furthes Correspondence.
Gold Coast—Further Papers relating to the Military Operations.
Circassian Tribes (Settlement of Emigrants)—Map.

Delivered on 12th July, 1864

371. Steam Vessels—Return.
444. Murder—Abstract of Return.
Public General Acts—Cap. 21 to 38 (both inclusive).

Delivered on 13th July, 1864.

280. Industrial and Provident Societies—Returns.
430. National Education (Ireland)—Return.
436. East India (Navy)—Return.
470. Cambrics, &c.—Return.
471. Cotton Manufacturing Districts—Report.
199. Bill—Poisoned Grain Prohibition, &c. (amended).
Vaccination of Sheep—Report.

Patents.

From Commissioners of Patents Journal, July 22nd.

GRANTS OF PROVISIONAL PROTECTION.

Aeriform fluids, obtaining power from—1636—M. P. W. Boulton.
Bottle-corking apparatus—1430—M. Smith and J. Smith.
Bottles, soda-water, &c., securing corks in—1650—E. Templemore.
Centrifugal machines—1631—J. Corby.
Cooking-stoves—1660—A. S. Tomkins.
Eggs, apparatus for sorting—1633—H. Field.
Endless band brush—1661—J. Taylor.
Felting machines—1612—W. Clark.
Gas, apparatus for carburetting—1229—L. Bricout.
Heating and evaporating liquids and fluids—1663—G. H. Palmer.
High-pressure cocks—1651—G. F. Graham and W. Payne.
Hooks for marine and other purposes—1630—R. Balans.
Hydrocarbon gas, manufacture of—1668—W. Lloyd.
Leather, pressed—1680—F. J. Bugg.
Locomotive engines—1672—J. E. Wilson.
Looms—1680—E. Ratcliffe and C. Ainsworth.
Organs, harmoniums, &c.—1477—W. Dawes.
Potato-planting implement—1682—J. Spencer.
Pumps—1658—W. Jackson, T. Glaholm, and S. S. Robson.
Railway carriages, self-adjusting couplings for—1646—A. V. Newton.
Railway carriage brakes—1573—W. Clark.
Railways, rails for permanent way of—1491—S. Truss.
Rope-making machinery—1361—S. Scrine.
Sewing machines—1632—A. Kimball.
Ships, means of bathing in—1579—J. Bailly.
Ships, composition for preventing fouling of—1652—W. B. Davis.
Slags, treating for production of cast steel—1656—S. Fox.
Steam-boilers, feed apparatus for—1654—W. G. Craig.
Steam fire-engines—1666—D. Blake.
Tubes, &c., removal of air, gas, &c., from—1638—F. L. H. Danchell.
Wine, &c., apparatus for decanting—1648—J. Ellis and J. Adams.
Yeast and starch manufacture—1624—C. Frielinghaus.

INVENTION WITH COMPLETE SPECIFICATION FILED.

Sewing and stitching machine—1788—T. F. Hodge.

PATENTS SEALED.

203. W. Ibotson.	245. S. Dixon & J. Calvert, jun.
212. S. Valle.	247. W. E. Maude.
220. R. A. Brooman.	252. P. A. le C. de Fontaine-Moreau.
222. W. Norton.	
223. H. C. Huskinson.	278. P. W. Gengembre.
228. W. E. Gedge.	279. S. Ferguson, jun.
236. E. W. James.	343. F. W. Webb.
237. J. Rodgers.	832. C. D. Tisdale.
241. N. J. Holmes.	

From Commissioners of Patents Journal, July 26th.

PATENTS SEALED.

244. G. Canouil.	321. H. A. Fletcher.
249. B. I'A. Bromwich.	345. J. H. Johnson.
250. T. M. Heathorn.	360. J. H. Johnson.
257. J. C. Haddan.	386. A. Steinmetz.
258. J. Phillips.	429. E. J. Leonard.
260. E. T. Hughes.	475. W. E. Newton.
274. D. Anderson.	510. J. Robinson.
281. G. Hammond and J. W. Kemp.	674. R. A. Brooman.
	722. G. T. Bousfield.
287. F. W. Webb.	738. W. Leuty.
298. G. Davies.	988. J. H. Johnson.
301. E. Lucius.	1081. R. A. Brooman.
305. J. Lee and J. Thomson.	1258. J. Webster.
312. M. Runkel.	1324. F. W. Brocksieper.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1758. J. Adams.	1840. W. E. Newton.
1824. R. A. Brooman.	1941. E. D. Johnson.
1825. J. H. Johnson.	1829. W. Price.
1876. E. Sang.	1841. J. Beattie.
1822. W. H. Harfield.	1843. G. F. Griffin.
1907. J. Rylands, J. G. Rylands, and P. Rylands.	1846. R. Thompson.
	1869. E. Haeffely.
1821. W. Savory & P. H. Savory.	1871. C. Robertson.
1830. R. Thatcher.	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

F. H. Holmes.